REMARKS

The Applicants respectfully request that the Examiner reconsider the rejection of the claims of the present application in the light of the foregoing amendments and the following remarks.

35 USC §102(b): Claims 1 to 8, 10 to 20, 22, and 25

The Examiner rejected Claims 1 to 8, 10 to 20, 22, and 25 under 35 USC §102(b) as being unpatentable over US Patent No. 4,931,760 (Yamaguchi et al.). In making the rejection, the Examiner stated.

> 5. With respect to Claim 1, Yamaguchi et al., teaches and shows "A magnetic assembly for an NMR apparatus" [See figures 1, 2, 10 and 12 through 14c; the abstract, and col. 3 line 36 through col. 14 line 35.], "comprising a plurality of primary permanent magnets disposed in an annular array about an axis (hereafter "longitudinal axis")" [See component 2 with col. 3 line 37 through col. 14 line 35; the abstract, and figures 1, 2, 10 and 12 through 14c], "the arrangement and/or characteristics of the plurality of magnets being such so as to create a zone of homogeneous magnetic field at some location along the axis forward of the array (and into the material when provided)" [See the detailed explanations concerning the generated magnetic field from col. 1 line 12 through col14 line 35 concerning the homogeneous magnetic field produced.].

Yamaguchi et al. relates to a magnetic field generator for a magnetic resonance imaging (MRI) instrument. The magnetic field generator described in Yamaguchi et al. has an array of permanent magnets (2) that have a trapezoidal shape in end view. The magnets (2) are arrayed around a central tube (6) to form an annular magnet (1). Field regulating magnets (4) are positioned on mounting plates (3). The mounting plates are mounted on the tube (6) which can be moved on a carriage along the longitudinal axis of the annular magnet (1) in order to perform a scan. The magnetic pieces (4) have magnetic field directions that are parallel to the corresponding magnetic field directions (5) of the permanent magnets (2). The magnetic field produced by the

permanent magnets (2) and the magnetic pieces (4) is provided in the region inside tube (6) so that MRI measurements can be taken there. The Yamaguchi et al. apparatus is illustrated in Figure 1 below.

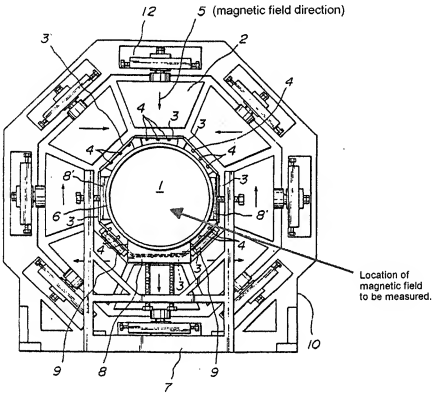

Fig-1

The Applicants' claimed magnetic assembly for an NMR apparatus as set forth in Claim 1 includes a plurality of primary magnets that are disposed in an annular array around a longitudinal

axis. Each of the primary magnets has north and south poles with an axis extending therebetween. The primary magnets are arranged around the longitudinal axis with their axes oriented at a non-parallel angle relative to the longitudinal axis. The non-parallel angle is selected to create a magnetic field zone at a location along the longitudinal axis forward of the array.

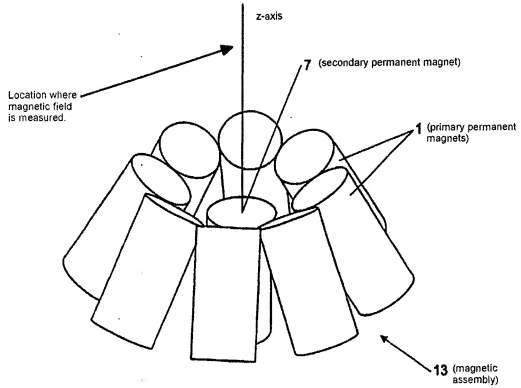

FIGURE 2

The claimed magnetic assembly also includes a secondary permanent magnet located on the longitudinal axis and positioned at least partly within the array of primary magnets. The position of the secondary magnet is selected to provide a zone of homogeneous magnetic field at

a location along the longitudinal axis forward of the array. Figure 2 above is an illustration of an embodiment of the Applicants' claimed magnetic assembly.

With the Applicants' claimed arrangement, the location and strength of the magnetic field can be adjusted along the longitudinal axis so as to penetrate the depth of a material to be analyzed. It is worthwhile to note that the Applicants' claimed arrangement does not require that the non-parallel angles of the primary magnet axes be the same angle relative to the longitudinal axis. For example, it is contemplated that for a particular embodiment the non-parallel angles can be of different sizes or can be positive or negative relative to the longitudinal axis.

The magnetic field generator described in Yamaguchi et al. does not anticipate the Applicants' claimed magnetic assembly for an NMR apparatus because it does not show or describe all of the features of the Applicants' claimed magnetic assembly. More specifically, Yamaguchi et al. does not show or describe (i) an array of primary magnets wherein each of the magnets has an axis extending between its north and south poles, (ii) the axis of each of the primary magnets is oriented at a non-parallel angle relative to the longitudinal axis of the array, and (iii) *the non-parallel angles are selected to provide a zone of homogeneous magnetic field at a location along the longitudinal axis forward of the magnet array.* Further, Yamaguchi et al. does not describe or show a magnetic assembly having (i) a secondary magnet located on the longitudinal axis of the primary magnet array (ii) at a position selected to provide a zone of homogeneous magnetic field at a location along the longitudinal axis forward of the magnet array in cooperation with the array of primary magnets.

The Applicants have discovered that enhanced homogeneity for one-sided NMR investigations is achieved by providing an annular array of primary permanent magnets disposed

about a longitudinal axis with the axis of each primary magnet oriented at a non-parallel angle relative to the longitudinal axis and by providing a secondary permanent magnet on the longitudinal axis at least partly within the array of primary magnets that is adjustable along the longitudinal axis, wherein the non-parallel angles and the position of the secondary magnet are selected to provide a zone of homogenous magnetic field at a location along the longitudinal axis forward of the array. Yamaguchi et al. neither describes nor suggests such an arrangement or the advantage that the Applicants' claimed arrangement provides.

Claims 3-5, 7-17, 20, and 22 depend from Claim 1 either directly or indirectly and thus, include all of the features set forth in Claim 1. Therefore, Claims 3-5, 7-17, 20, and 22 are novel relative to Yamaguchi et al. for at least the same reasons as Claim 1.

The Applicants' claimed nuclear magnetic resonance apparatus, as set forth in Claim 25, includes a plurality of primary magnets that are disposed in an annular array around a longitudinal axis. The claimed apparatus also includes a secondary permanent magnet located on the longitudinal axis and positioned at least partly within the array of primary magnets. The position of the secondary magnet is adjustable along the longitudinal axis relative to the array of primary magnets so that the position of the secondary magnet can be selected to provide a zone of homogeneous magnetic field at a location along the longitudinal axis forward of the array.

Yamaguchi et al. neither describes nor suggests providing a secondary permanent magnet on the longitudinal axis of the annular magnet. Indeed, the placement of a secondary magnet on the longitudinal axis of the annular magnet would prevent or inhibit the placement of a specimen or patient in the tube where the measurements are taken. Nor does Yamaguchi et al. describe or suggest a nuclear magnetic resonance apparatus having a secondary permanent magnet that can be

moved along the longitudinal axis of the primary magnet array so that the position of the secondary magnet can be selected to provide a zone of homogeneous magnetic field at a location along the longitudinal axis forward of the array. As discussed above, in the apparatus described in Yamaguchi et al., the magnetic field is formed within the annular magnet (1) such that it is located within the tube (6). For all of these reasons, Yamaguchi et al. does not anticipate the Applicants' claimed nuclear magnetic resonance apparatus as set forth in Claim 25.

The Applicants have discovered that enhanced homogeneity for one-sided NMR investigations is achieved by providing an annular array of primary permanent magnets disposed about a longitudinal axis in combination with a secondary permanent magnet on the longitudinal axis at least partly within the array of primary magnets that is adjustable along the longitudinal axis wherein the position of the secondary magnet is selected to provide a zone a homogenous magnetic field at a location along the longitudinal axis forward of the array. Yamaguchi et al. neither describes nor suggests such an arrangement or the advantage that the claimed arrangement provides.

35 USC §102(e): Claims 1, 20, 21, and 26

The Examiner rejected Claims 1, 20, 21, and 26 under 35 USC §102(e) as being unpatentable over US Patent No. 6,457,433 (Locatelli et al.). In making the rejection, the Examiner stated.

> With respect to Claim 1, Locatelli et al., teaches and shows "A magnetic assembly for an NMR apparatus" [See figures 1, 2; the abstract, and col. 1 line 40 through col. 3 line 31.], "comprising a plurality of primary permanent magnets disposed in an annular array about an axis (hereafter "longitudinal axis")" [See components 1 through 8 of figure 1], "the arrangement and/or characteristics of the plurality of magnets being such so as to create a zone of homogeneous magnetic field at some location along the axis forward of the array (and into the material when provided)"

> [See the detailed explanations concerning the generated magnetic field from col. 1 line 40 through col. 3 line 31 concerning the homogeneous magnetic field produced.].

Locatelli et al. relates to a portable NMR measurement device. In this regard, Locatelli et al. describes and shows an array of permanent magnets (1-8), each having a trapezoidal cross section. The magnets are arrayed around a central opening. The magnetic axes of the several magnets in the Locatelli et al. device are oriented such that a magnetic field is formed in a zone (20) on an axis "A", external to the magnet array.

The Applicants' claimed magnetic assembly as set forth in Claim 1 includes a secondary permanent magnet located on the longitudinal axis of an array of primary permanent magnets in addition to the annular array of primary permanent magnets. The secondary magnet is positioned at least partly within the array of primary magnets. The position of the secondary magnet is selected to provide a zone of homogeneous magnetic field at a location along the longitudinal axis forward of the array.

The nuclear magnetic resonance device described in Locatelli et al. does not anticipate the Applicants' claimed magnetic assembly for an NMR apparatus because it does not show or describe all of the features of the Applicants' claimed magnetic assembly. More specifically, Locatelli et al. does not describe or show a magnetic assembly having (1) a secondary magnet located on the longitudinal axis of the primary magnet array (2) at a position selected to provide a zone of homogeneous magnetic field at a location along the longitudinal axis forward of the magnet array in cooperation with the array of primary magnets.

The Applicants have discovered that enhanced homogeneity for one-sided NMR

investigations is achieved by providing an annular array of primary permanent magnets disposed about a longitudinal axis with the axis of each primary magnet oriented at a non-parallel angle relative to the longitudinal axis in combination with a secondary permanent magnet on the longitudinal axis at least partly within the array of primary magnets, wherein the non-parallel angles and the position of the secondary magnet are selected to provide a zone of homogenous magnetic field at a location along the longitudinal axis forward of the array. Locatelli et al. neither describes nor suggests such an arrangement or the advantage that the claimed arrangement provides.

Claims 20, 21, and 26 depend from Claim 1 either directly or indirectly and thus include all of the features set forth in Claim 1. Therefore, Claims 20, 21, and 26 are novel relative to Locatelli et al. for at least the same reasons as Claim 1.

35 USC §103(a): Claim 9

The Examiner rejected Claim 9 under 35 USC §103(a) as being unpatentable over Yamaguchi et al. In making the rejection, the Examiner stated.

> With respect to Claim 9, Yamaguchi et al., lacks a direct verbatim recitation of applicant's mathematics for the tapered magnetic block arrangement, however Yamaguchi et al., does recite the mathematics involved in forming tapered trapezoidal magnetic blocks, [See the mathematical explanations from col. 6 line 38 through col. 13 line 39.] Therefore, It [sic] would have been obvious to one of ordinary skill in the art at the time that the invention was made that the Yamaguchi et al., reference does teach the same basic mathematical formation of applicant's equation of claim 9. The difference in notation, is an obvious variation since each individual is allowed to be his/her own lexicographer.

Claim 9 depends from Claim 1 indirectly through Claims 7 and 8, and thus, Claim 9 includes all of the features of Claims 1, 7, and 8. As discussed above, Yamaguchi et al. does not

anticipate Claims 1, 7, or 8. Therefore, Claim 9 is patentable over Yamaguchi et al. for at least the same reasons as Claim 1.

35 USC §103(a): Claims 23, 24, and 27

The Examiner rejected Claims 23, 24, and 27 under USC §103(a) as being unpatentable over Locatelli et al. In explaining the rejection relative to Claim 23, the Examiner stated.

> With respect to Claim 23, Locatelli et al., lacks directly teaching that the apparatus is operable in such a fashion as to allow excitation of one volume V_a of the material, being one of a plurality of volumes V_1 to V_n existing as slices along the longitudinal axis." However, Locatelli et al., teaches that an induced magnetic cylinder of 15mm diameter and 12 mm long occupying $2cm^3$ the center of which is 25mm from the output of the magnetic system is produced as an induced excitation for examination of a subject, which corresponds to applicant's volume of excitation V_a. Because the device of Locatelli et al., is portable and movable over a subject, It would have been obvious to one of ordinary skill in the art at the time that the invention was made that the volume V_a of the material", is represented as "being one of a plurality of volumes V_1 to V_n existing as slices along the longitudinal axis" which are capable- of being produced by the Locatelli et al., invention. The same reasons for rejection, which apply to claims 1, 20 also apply to claim 23 and need not be reiterated.

Claims 23 and 24 depend from Claim 1 indirectly through Claim 20, and thus, Claims 23 and 24 include all of the features of Claims 1 and 20. As discussed above, Locatelli et al. does not anticipate Claim 1 or Claim 20. Therefore, Claims 23 and 24 are patentable over Yamaguchi et al. for at least the same reasons as Claim 1.

In explaining the rejection of Claim 27, the Examiner stated.

> With respect to Claim 27,.Locatelli et al., lacks teaching that "subsequent to step c)" , the step of "d) substantially immediately following excitation of volume V_a, causing excitation of subject nuclei in a volume V_b, wherein V_b is a volume differing from V_a only in its position along the longitudinal axis; and e) detecting radio frequency emissions from the subject nuclei in the volume V_b "However, the

> examiner notes that, Locatelli et at, does suggest limitation d) for the same reasons as those provided in the rejection of claim 24 above. Additionally, limitation e) is taught by Locatelli et al., for the same reasons as those already provided in the rejection of 26 above, therefore, It would have been obvious to one of ordinary skill in the art at the time that the invention was made that the Locatelli et al., invention is capable of performing the method steps of claim 27. The same reasons for rejection, which apply to claims 1, 20, 23, 24, [and] 26 also apply to claim 27 and need not be reiterated.

Claim 27 depends from Claim 1 indirectly through Claim 26, and thus, Claim 27 includes all of the features of Claims 1 and 26. As discussed above, Locatelli et al. does not anticipate Claim 1 or Claim 26. Therefore, Claim 27 is patentable over Locatelli et al. for at least the same reasons as Claim 1.

CONCLUSION

In view of the foregoing amendments and remarks, it is believed that this application is in condition for allowance. The Applicants respectfully requests entry of the amendments presented hereinabove and reconsideration of the rejections set forth in the Official Action so that this application may proceed to allowance.

Respectfully submitted,

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